MARKED-UP COPY OF AMENDED SPECIFICATION PARAGRAPHS:

[0008] According to another aspect of the present invention, there is provided a data processing system comprising: M first arbitrator means (where M is a natural number greater than one) each for arbitrating operations of corresponding N processing units (where N is a natural number greater than one), the N processing units cooperating to perform cooperative processing, second arbitrator means for arbitrating operations of the M first arbitrator means, and control means for controlling operations of the first and second arbitrator means, such that each processing unit initiates processing assigned thereto, in response to reception of an execution enable signal sent from the control means, and after execution of the processing, each processing unit sends a processing result and an execution end signal to the control means, wherein the control means has a processing table for each application, the processing table storing, in a predetermined order, identification information on one or more processing units to which the execution enable signal is to be sent, and identification information on one or more processing units from which the processing result and the execution end signal are to be received, whereby, in response to receipt of a processing request from an application, the execution enable signal is sent to the one or more processing units and the processing result and the execution end signal are received from the one or more processing units, in the order determined by the corresponding processing table for the application.

[0030]   A ~~Description~~description will ~~now~~ be made ~~first about~~ ~~of~~ an embodiment in which a data processing system according to the present invention is applied to an integrated image

processing apparatus provided with two or more image processing
units that ~~cooperate to~~ carry out cooperative processing.

[0038]   The sub-CP 5 controls the operation of the entire GSB.
The sub-CP ~~3~~5 is equipped with a demultiplexer (not shown) for
dividing the input data into four parts and distributing to each
of the four GSMs 1 a quarter of the image data string related to
a moving image to be generated.   The distribution may take
various forms depending on the application software run on the
apparatus.   For example, the whole area of an image to be
finally displayed may be divided into four parts, or into four
image data strings, each of which is to display a corresponding
layer to be superimposed one upon another for the final image.
Alternatively, image data that has combined four frames into one
may be divided into four parts.

[0039]   The sub-~~MET~~NET 6 is a circuit for passing part or all
of the image data string between its own GSB and another GSB.
The image data string is passed mainly to balance the load of
image processing among the GSBs.

[0040]   It should be noted that merging performed by the sub-
MG 3 is carried out in synchronization with an absolute time
base that controls the operation of all the ~~entire GSB~~GSBs.   In
other words, the sub-MG 3 merges two or more pieces of frame
image data input in synchronization with the absolute time base
to generate one frame of image data.

[0054]   The GIF 30 arbitrates the ~~collision between~~ transfer
of the display lists created in the first VPU 20 and the second
VPU 21 during the transfer operation.   In the embodiment, the
GIF 30 has an additional function for putting these display
lists in the order of priority and transferring them to the GS
31 sequentially in order of precedence.   Information indicative

of priority of each display list is generally described in a tag field of the display list when the VPU 20 or 21 creates the display list, but the priority may be judged independently by the GIF 30.

[0062]   Next, a description will be made about an exemplary form of data processing executed in the integrated image processing apparatus.

[0064]   In the embodiment, a display sequence table TB is prepared for each application.   The display sequence table TB stores in a predetermined order IDs of the GSMs 1 to which the drawing enable signal (DrawNext) is to be sent and IDs of the GSMs 1 from which the drawing end signal (DrawDone) is to be received.   The display sequence table TB is provided in any one of the external storage 410 on the main CP 400 side, the data register of the main MG 200, and the data register of the main SYNC 300.   In other words, the display sequence table TB is provided in a region in which the main SYNC 300 can point to the contents thereof.

[0068]   The SYNC 300 points (e.g., provides) each GSM group with two indexes "Display Start" and "Display End."   The index "Display Start" indicates that the GSM group is scheduled to make an image display on the display unit DP on the basis of the processing results after ending the drawing process (after receiving the drawing end signal (DrawDone)).   The index "Display End" indicates that the GSM group is in such a state that it can issue the drawing enable signal for the next frame after a period of display of a one-frame image on the display unit DP.   When the single buffer system is adopted, the display of the next frame image is started after completion of the display of the previous frame image.   When the double buffer system is adopted, the display start processing and the display

17

end processing are carried out at the same time. Therefore, as shown at (a) and (b) in Fig. 4, the display timing in the single buffer system is delayed by one-SYNC compared to that in the double buffer system.

[0069]   Next, a description will be made about an operation form of the integrated image processing apparatus configured such as above.   The integrated image processing apparatus operates on the presumption that an application has been loaded to into the external storage 410 so that an image data string can be supplied to each GSM 1 through the main CP 400 and the sub-CP 5 in each GSB 100.

[0070]   The main CP 400 launches the application, and when a processing request is made from the application, it gives drawing instructions to the main SYNC 300 through the main MG 200.   Upon receipt of the drawing instructions from the main CP 400, the main SYNC 300 sends the drawing enable signal (DrawNext) to corresponding GSMs 1 in the order of storage on the display sequence table TB for the application concerned.

[0072]   In the single buffer system, the GSM 1 executes processing steps shown at (a) in Fig. 5.

[0104]   Although the invention herein has been described with reference to paraticular particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention.   It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

MARKED-UP COPY OF AMENDED CLAIMS:

1. (Amended) A data processing system ~~including~~, comprising:

a plurality of processing units ~~and control means for controlling operations of said processing units, such that each processing unit initiates~~ each operable to initiate processing assigned thereto~~,~~ in response to reception of an execution enable signal ~~sent from the control means, and after execution of the processing, each processing unit sends~~ and to produce a processing result and an execution end signal ~~to the control means, wherein~~ after completion of said processing;

~~said control means has~~ a respective processing table for each ~~of a plurality of application~~ of a plurality of applications, said processing table storing, in a predetermined order, identification information on one or more of said processing units to which ~~the~~ said execution enable signal is to be sent, and identification information on one or more of said processing units from which ~~the~~ said processing result and ~~the~~ said execution end signal are to be received~~, whereby~~; and

a control unit operable to control said processing units such that, in response to receipt of a processing request from ~~an~~ a given application, ~~the~~ said execution enable signal is sent to said one or more processing units and ~~the~~ said processing result and ~~the~~ said execution end signal are received from said one or more processing units, in ~~the~~ said order determined by ~~the~~ said corresponding processing table for said application.

2. (Amended) The data processing system according to claim 1, wherein said processing units cooperate with one another to create frame image data with respect to divided images of a predetermined image, and to output ~~the~~ said created frame image data as said processing ~~results~~ result.

3.   (Amended)   The   data processing   system   according   to
claim 1, wherein:

each of said processing units includes drawing processing
means for drawing a predetermined image, a plurality of geometry
processing means for performing geometry processing based on ~~the
basis of~~ predetermined image display instructions, and an image
interface which intervenes between said drawing processing means
and said geometry processing means~~, and~~;

said   drawing   processing   means   includes   a   buffer   for
storing,   together   with   identification   information,   different
drawing contexts ~~that are different in the contents from one
another~~ for each of said geometry processing means, and means
for   reading   a   specific   drawing   context   from   said   buffer   in
response   to   ~~input of~~ a   drawing   instruction   from   said   image
interface   and   for   drawing   an   image   based   on   ~~the read~~ said
drawing context~~, such that~~;

each   of   said   geometry   processing   means   performs   geometry
processing   independently   based   on   ~~the basis of the~~said   image
display   instructions   and   sends   to   said   image   interface   an   image
transfer   request   containing   ~~the~~ said   identification   information
~~on the~~ for   said   drawing   context   ~~acquired as a result of the~~
resulting   from   said   geometry   processing   together   with
information indicative of an order of priority given thereto~~,~~
~~and~~;

said   image   interface   receives   ~~the~~ said   image   transfer
requests from said geometry processing means in ~~the~~ said order
of priority to sequentially input ~~the~~ said drawing instructions
to said drawing processing means~~, whereby~~; and

a   result   of   ~~the~~ said   image   drawing   performed   by   said
drawing processing means is output as said processing result.

4. (Amended) The data processing system according to claim 3, further comprising means for concurrently displaying ~~the~~ said results of ~~the~~ said image drawing respectively performed by ~~the~~ said processing units, on one display screen ~~at the same time~~.

5. (Amended) The data processing system according to claim 3, further comprising means for sequentially displaying ~~the~~ said results of ~~the~~ said image drawing respectively performed by ~~the~~ said processing units, on one display screen ~~in sequence~~.

6. (Amended) A data processing system, comprising:

respective sets of N processing units (where N is a natural number greater than one) each operable to perform cooperative processing such that each processing unit initiates processing assigned thereto in response to reception of an execution enable signal, and produces a processing result and an execution end signal after completing of said processing;

a plurality of M first arbitrator means (where M is a natural number greater than one) each for arbitrating operations of ~~corresponding~~ one of said respective sets of N processing units ~~(where N is a natural number greater than one), said N processing units cooperating to perform cooperative processing~~;

second arbitrator means for arbitrating operations of ~~the~~ said M first arbitrator means~~, and control means for controlling operations of the first and second arbitrator means, such that each processing unit initiates processing assigned thereto, in response to reception of an execution enable signal sent from the control means, and after execution of the processing, each processing unit sends a processing result and an execution end signal to the control means,~~ wherein;

~~said control means has~~ a respective processing table for each of a plurality of ~~application~~applications, said processing table storing, in a predetermined order, identification information on one or more of said processing units to which ~~the~~ said execution enable signal is to be sent, and identification information on one or more of said processing units from which ~~the~~ said processing result and ~~the~~ said execution end signal are to be received~~, whereby,~~ ;

a control unit operable to control said processing units such that, in response to receipt of a processing request from ~~an~~ a given application, ~~the~~ said execution enable signal is sent to said one or more processing units and ~~the~~ said processing result and ~~the~~ said execution end signal are received from said one or more processing units, in ~~the~~ said order determined by ~~the~~ said corresponding processing table for said application.

7. (Amended) The data processing system according to claim 6, wherein said processing units cooperate with one another to create frame image data with respect to divided images of a predetermined image, and to output ~~the~~ said created frame image data as said processing ~~results~~result.

8. (Amended) The data processing system according to claim 6, wherein:

each of said processing units includes drawing processing means for drawing a predetermined image, a plurality of geometry processing means for performing geometry processing based on ~~the basis of~~ predetermined image display instructions, and an image interface which intervenes between said drawing processing means and said geometry processing means~~, and~~ ;

said drawing processing means includes a buffer for storing, together with identification information, different drawing contexts ~~that are different in the contents from one~~

~~another~~ for each of said geometry processing means, and means for reading a specific drawing context from said buffer in response to ~~input of~~ a drawing instruction from said image interface and for drawing an image based on ~~the read~~ said drawing context~~, such that~~;

each of said geometry processing means performs geometry processing independently based on ~~the basis of the~~said image display instructions and sends to said image interface an image transfer request containing ~~the~~said identification information ~~on the~~ for said drawing context ~~acquired as a result of the~~ resulting from said geometry processing together with information indicative of an order of priority given thereto~~,~~ ~~and~~;

said image interface receives ~~the~~ said image transfer requests from said geometry processing means in ~~the~~said order of priority to sequentially input ~~the~~said drawing instructions to said drawing processing means~~, whereby~~; and

a result of ~~the~~said image drawing performed by said drawing processing means is output as said processing result.

9. (Amended) The data processing system according to claim 8, further comprising means for concurrently displaying ~~the~~said results of ~~the~~said image drawing respectively performed by ~~the~~said processing units, on one display screen ~~at the same time~~.

10. (Amended) The data processing system according to claim 8, further comprising means for sequentially displaying ~~the~~said results of ~~the~~said image drawing respectively performed by ~~the~~said processing units, on one display screen ~~in sequence~~.

11.   (Amended) A data processing system for controlling operations of a plurality of processing units, such that each processing unit initiates processing assigned thereto, in response to reception of an execution enable signal, and after execution of the processing, each processing unit and outputs a processing result and an execution end signal after completion of said processing, said data processing system comprising:

first means for holding a respective processing table for each of a plurality of applicationapplications, said processing table storing, in a predetermined order, identification information on one or more of said processing units to which the said execution enable signal is to be sent, and identification information on one or more of said processing units from which the said processing result and the said execution end signal are to be received;

second means for, in response to receipt of a processing request from an application, identifying a corresponding one of said processing table for said applicationtables in response to a processing request from a given one of said applications; and

third means for sending the said execution enable signal to said one or more processing units and receiving the said processing result and the said execution end signal from said one or more processing units, in the said order determined by the said identified processing table.

12.   (Amended) The system according to claim 11, wherein each of said processing units is includes a computer having a communication capability, whereby

the said execution enable signal and the said execution end signal are exchanged with respect to between at least said processing units through a computer network.

13.   (Amended) A data processing system for controlling ~~operations of~~ respective sets of N processing units (where N is a natural number greater than one) each operable to perform cooperative processing such that each processing unit initiates processing assigned thereto in response to reception of an execution enable signal, and produces a processing result and an execution end signal after completing of said processing;

a plurality of M first arbitrator means (where M is a natural number greater than one) each for arbitrating operations of ~~corresponding~~ one of said respective sets of N processing units ~~(where N is a natural number greater than one), said N processing units cooperating to perform cooperative processing~~; and

~~an operation of~~ a second arbitrator means for arbitrating ~~the~~ said operations of ~~the~~ said M first arbitrator means, ~~such that each processing unit initiates processing assigned thereto, in response to reception of an execution enable signal, and after execution of the processing, each processing unit outputs a processing result and an execution end signal,~~ said system comprising:

first means for holding a respective processing table for each of a plurality of ~~application~~applications, said processing table storing, in a predetermined order, identification information on one or more of said processing units to which ~~the~~ said execution enable signal is to be sent, and identification information on one or more of said processing units from which ~~the~~said processing result and ~~the~~said execution end signal are to be received;

second means for~~, in response to receipt of a processing request from an application,~~ identifying a corresponding one of said processing ~~table for said application~~tables in response to a processing request from a given one of said applications; and

25

third means for sending ~~the~~ said execution enable signal to said one or more processing units and receiving ~~the~~ said processing result and ~~the~~ said execution end signal from said one or more processing units, in ~~the~~ said order determined by ~~the~~ said identified processing table.

14.   (Amended) The system according to claim 13, wherein each of said processing units ~~is~~ includes a computer having a communication capability, whereby

~~the~~ said execution enable signal and ~~the~~ said execution end signal are exchanged ~~with respect to~~ between at least said processing units through a computer network.

15.   (Amended) A data processing method for controlling a plurality of processing units each initiating processing assigned thereto~~,~~ in response to reception of an execution enable signal~~,~~ and ~~after execution of the processing, each~~ outputting a processing result and an execution end signal after completion of said processing, so that ~~the~~ said processing results from ~~part of~~ some or all of said processing units are displayed on a display unit, said method comprising ~~the steps of~~:

setting, in a predetermined order for each of a plurality of ~~application~~applications, identification information on one or more of said processing units to which ~~the~~ said execution enable signal is to be sent, and identification information on one or more of said processing units from which ~~the~~ said processing result and ~~the~~ said execution end signal are to be received;

sending, in response to receipt of a processing request from ~~an~~ a given application, ~~the~~ said execution enable signal to said one or more processing units and receiving ~~the~~ said processing result and ~~the~~ said execution end signal from said

one or more processing units, in ~~the~~ said order determined for
said application; and

displaying ~~the received~~ said processing result at a
predetermined timing on said display unit.

16. (Amended) A storage medium containing a computer
program for causing a computer to operate as a data processing
system which controls operations of a plurality of processing
units each initiating processing assigned thereto~~,~~ in response
to reception of an execution enable signal~~,~~ and ~~after execution
of the processing, each~~ outputting a processing result and an
execution end signal after completion of said processing, said
data processing system comprising:

first means for holding a respective processing table for
each of a plurality of ~~application~~applications, said processing
table storing, in a predetermined order, identification
information on one or more of said processing units to which ~~the~~
said execution enable signal is to be sent, and identification
information on one or more of said processing units from which
~~the~~ said processing result and ~~the~~ said execution end signal are
to be received;

second means for~~, in response to receipt of a processing
request from an application,~~ identifying a corresponding one of
said processing ~~table for said application~~tables in response to
a processing request from a given one of said applications; and

third means for sending ~~the~~ said execution enable signal to
said one or more processing units and receiving ~~the~~ said
processing result and ~~the~~ said execution end signal from said
one or more processing units, in ~~the~~ said order determined by
~~the~~ said identified processing table.

17. (Amended) A computer-readable recording medium
~~recording the~~ containing a computer program ~~according to claim~~

27

11 for causing a computer to operate as a data processing system which controls operations of a plurality of processing units each initiating processing assigned thereto in response to reception of an execution enable signal and outputting a processing result and an execution end signal after completion of said processing, said computer program for causing said data processing system to execute steps comprising:

setting, in a predetermined order for each of a plurality of applications, identification information on one or more of said processing units to which said execution enable signal is to be sent, and identification information on one or more of said processing units from which said processing result and said execution end signal are to be received;

sending, in response to receipt of a processing request from a given application, said execution enable signal to said one or more processing units and receiving said processing result and said execution end signal from said one or more processing units, in said order determined for said application; and

displaying said processing result at a predetermined timing on said display unit.

REMARKS

       Applicants respectfully request consideration and allowance of claims 1-17, which are pending in the above-identified patent application. Applicants have amended claims 1-17 to place them in better form for U.S. practice. No new matter is added by the drawing changes.

       Applicants have amended the specification (including the Abstract) to correct for minor typographical and grammatical errors. No new matter is added by the specification amendments.

       In light of the above, Applicants submit that the instant application is in condition for allowance. Early and favorable action is earnestly solicited. If, however, for any reason the Examiner does not believe such action can be taken, it is respectfully requested that he or she telephone Applicants' attorney at (908) 654-5000 in order to overcome any objections that he or she may have.

Dated: March 11, 2002   Respectfully submitted,

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29